CLAIMS

What is claimed is:

1. A compressor comprising:

a diffuser;

a volute defining an open space in fluid communication with said diffuser; and

an impeller operable to compress a fluid stream and direct said fluid stream to said volute, said impeller including:

a hub having an axis of rotation; and

a plurality of blades extending from said hub, said blades having a surface defined by an axial direction (Z), a radius (R) defined from said axis of rotation of said hub, and a polar angle (Θ), whereby the polar angle (Θ) is substantially defined by the equation: Θ = a * [natural logarithm of (R)] + b.

2. The compressor of claim 1, wherein each of said blades includes a leading edge and a trailing edge, said leading edge formed proximate said hub and said trailing edge formed proximate said volute.

3. The compressor of claim 2, wherein a and b are constants determined from a blade angle of said leading edge, said leading edge blade angle generally determined by output requirements of the compressor.

4.   The compressor of claim 1, wherein said diffuser is vaneless, said vaneless diffuser including a generally open space in fluid communication with said open space of said volute.

5.   The compressor of claim 1, wherein said impeller is a radial impeller, said radial impeller including an inducer formed proximate a leading edge of each blade.

6.   The compressor of claim 5, wherein said inducer includes a height component in said axial direction (Z) which is 5-7% of an outer diameter of said impeller.

7.   The compressor of claim 1, wherein said impeller is a mixed-flow impeller.

8.   The compressor of claim 7, further comprising an area reduction formed along each of said blades between a leading edge and a trailing edge.

9.   The compressor of claim 8, wherein said area reduction includes an area being between 2/3 and 3/4 an area of said leading edge of each blade.

10.   The compressor of claim 8, wherein said area reduction is formed along each of said blades a distance X from said leading edge, said distance X approximately equal to 1/3 of a total blade length as measured along said radius (R).

11.   An impeller comprising:

a hub having an axis of rotation; and

a plurality of blades extending from said hub, said blades having a surface defined by an axial direction (Z), a radius (R) defined from said axis of rotation of said hub, and a polar angle (Θ), whereby the polar angle (Θ) is substantially defined by the equation: Θ = a * [natural logarithm of (R)] + b.

12.   The impeller of claim 11, wherein each of said blades includes a leading edge and a trailing edge.

13.   The impeller of claim 12, wherein a and b are constants determined from a blade angle of said leading edge, said leading edge blade angle generally determined by output requirements of the compressor.

14.   The impeller of claim 11, wherein said impeller is a radial impeller, said radial impeller including an inducer formed proximate a leading edge of each blade.

15.   The compressor of claim 14, wherein said inducer includes a height component in said axial direction (Z) which is 5-7% of an outer diameter of said impeller.

16.   The compressor of claim 11, wherein said impeller is a mixed-flow impeller.

17.   The compressor of claim 16, further comprising an area reduction along each of said blades between a leading edge and a trailing edge.

18.   The compressor of claim 17, wherein said area reduction includes an area being between 2/3 and 3/4 an area of a leading edge of each blade.

19.   The compressor of claim 17, wherein said area reduction is formed along each of said blades a distance X from said leading edge, said distance X approximately equal to 1/3 of a total blade length as measured along said radius (R).

20.   A compressor comprising:

a vaneless diffuser;

a volute in fluid communication with said vaneless diffuser; and

a radial impeller operable to compress a fluid stream and direct said fluid stream to said volute, said radial impeller including:

a hub having an axis of rotation; and

a plurality of blades extending from said hub, said blades having a surface defined by an axial direction (Z), a radius (R) defined from said axis of rotation of said hub, and a polar angle (Θ), whereby the polar angle (Θ) is substantially defined by the equation: $\Theta = a * [\text{natural logarithm of } (R)] + b$; and

an inducer formed proximate a leading edge of said blades, said inducer having a height as a function of said axial direction (Z), said height being 5-7% of an outer diameter of said radial impeller.

21.   A compressor comprising:

a vaneless diffuser;

a volute in fluid communication with said vaneless diffuser; and

a mixed-flow impeller operable to compress a fluid stream and direct said fluid stream to said volute, said mixed-flow impeller including:

a hub having an axis of rotation; and

a plurality of blades extending from said hub, said blades having a surface defined by an axial direction (Z), a radius (R) defined from said axis of rotation of said hub, and a polar angle (Θ), whereby the polar angle (Θ) is substantially defined by the equation: Θ = a * [natural logarithm of (R)] + b; and

wherein each of said blades includes a leading edge and a trailing edge, said trailing edge having an area at or between 2/3 to 3/4 an area of said leading edge.